Armed Forces College of Medicine

AFCM

(**spinal cord anatomy**)

Spinal Cord
Gross morphology & internal structure

By Professor

Dr Shahira Youssef

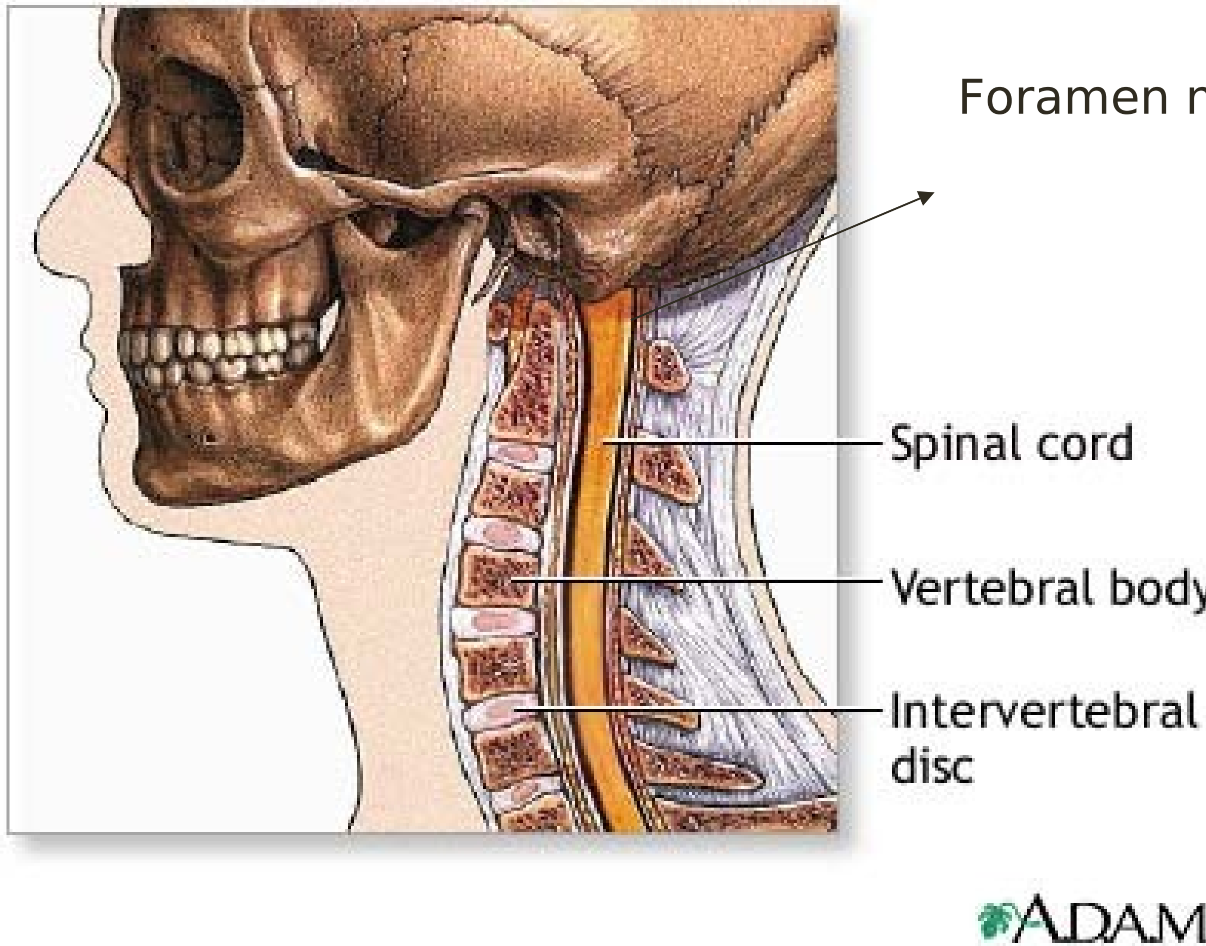
Professor of Anatomy and Embryology

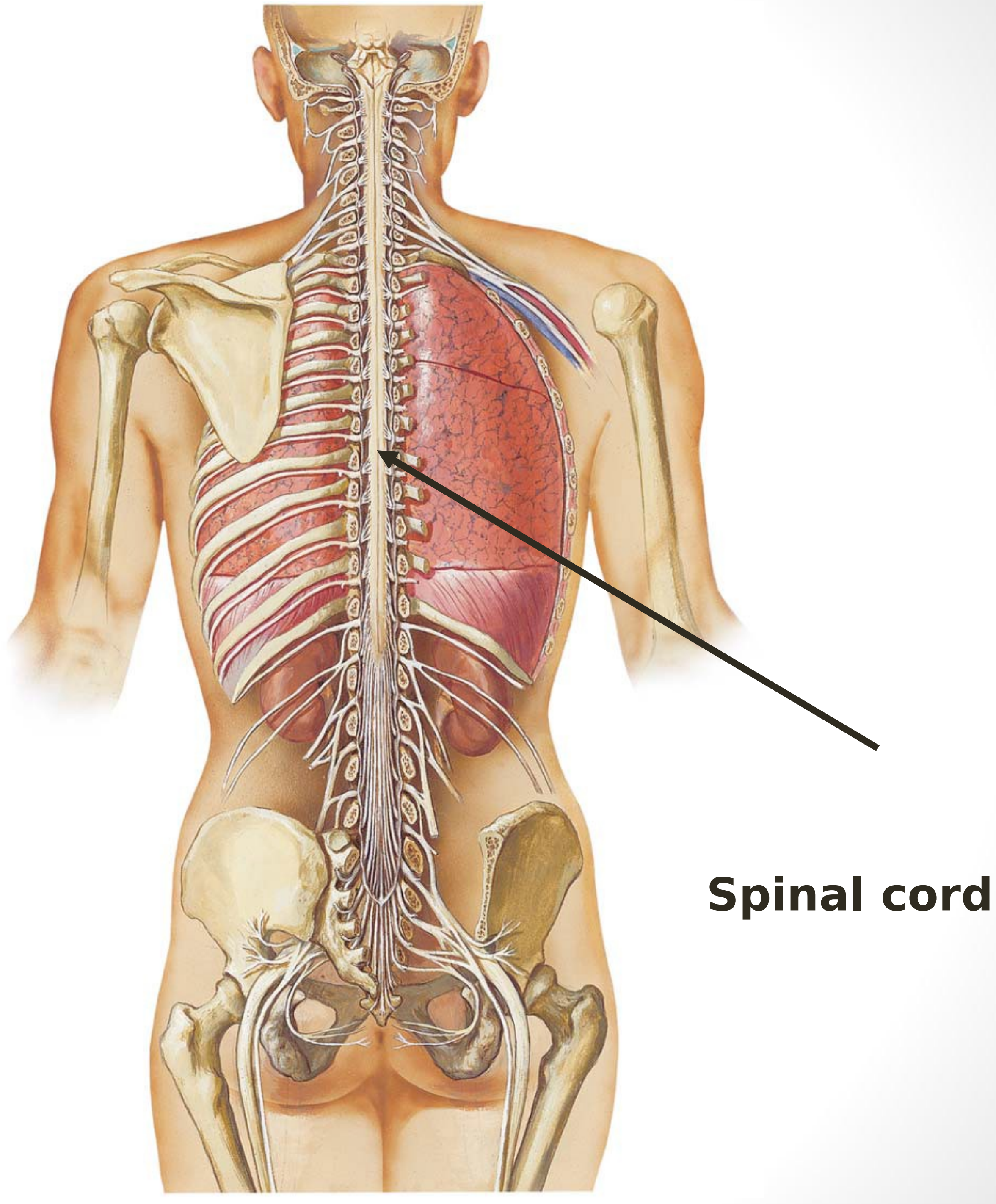
ILOS

- **Describe** the gross morphology of spinal cord (external features, internal structure, covering meninges)
- **Describe** attachments of spinal nerves.
- **Locate** where to do lumbar puncture.

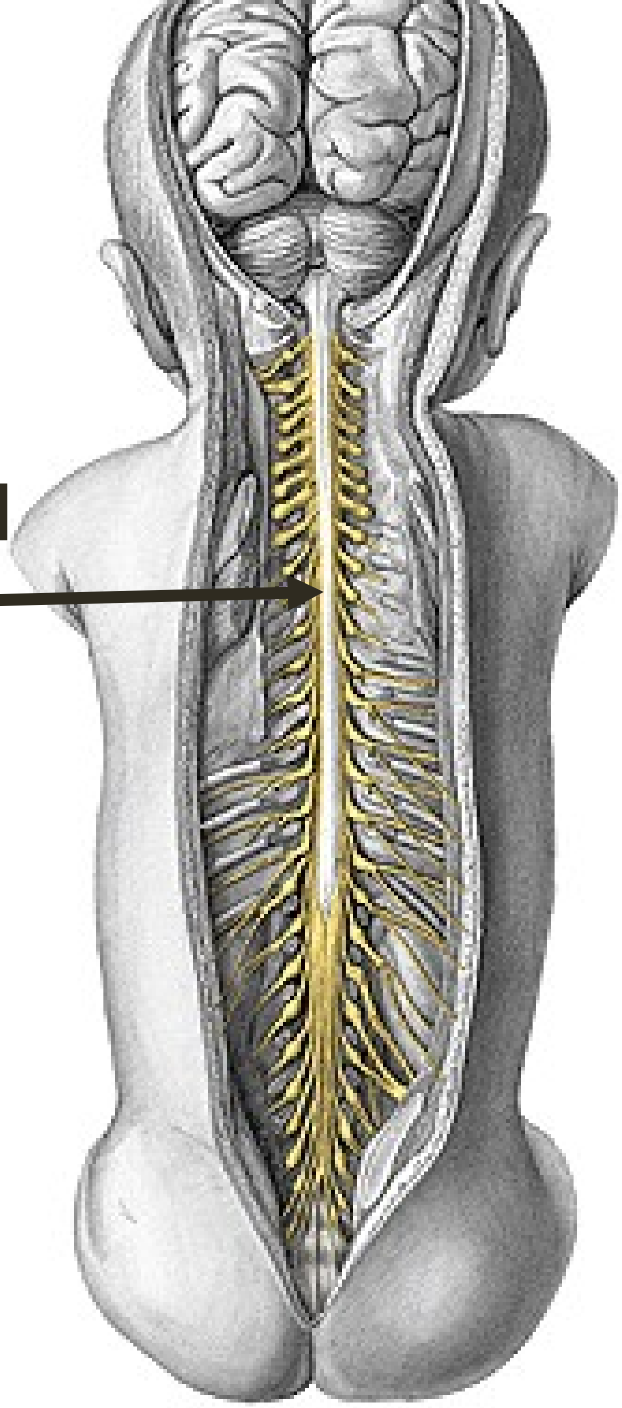
External Features

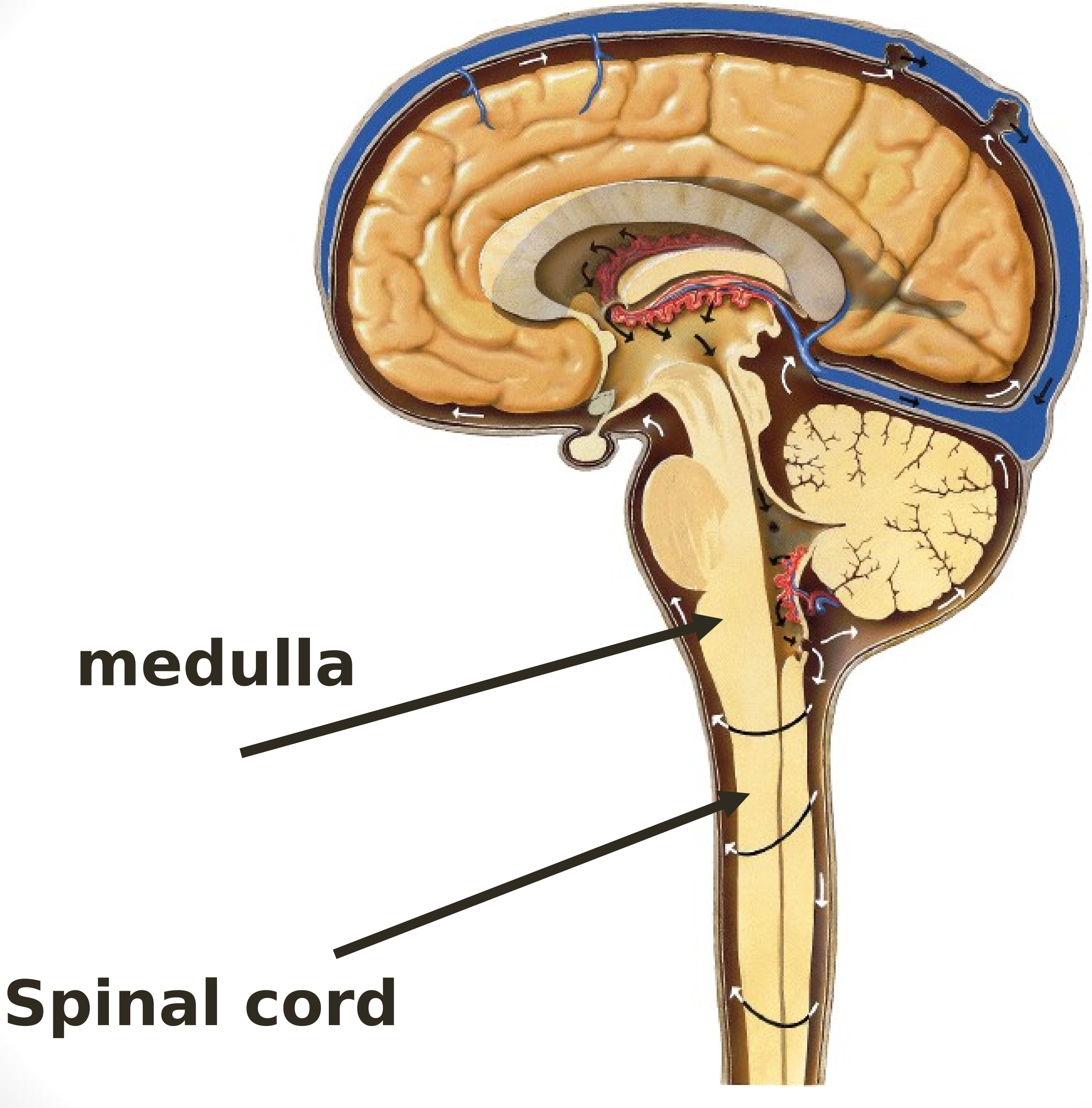
- Part of central nervous system, it occupies upper two thirds of vertebral canal
- Cylindrical
- Length : 45 cm
- Begins at upper border of atlas as continuation of medulla
- Ends at lower border of first lumber in adults & at birth it lies opposite L3
- 2 enlargements: cervical and lumbar
- Tapering lower end is called conus medullaris
- It has anterior median fissure and posterior median sulcus& 2 anteorlateral & 2 posterolateral sulci


Foramen magnum
Spinal cord
Vertebral body
Intervertebral disc
A.D.A.M.


Spinal cord

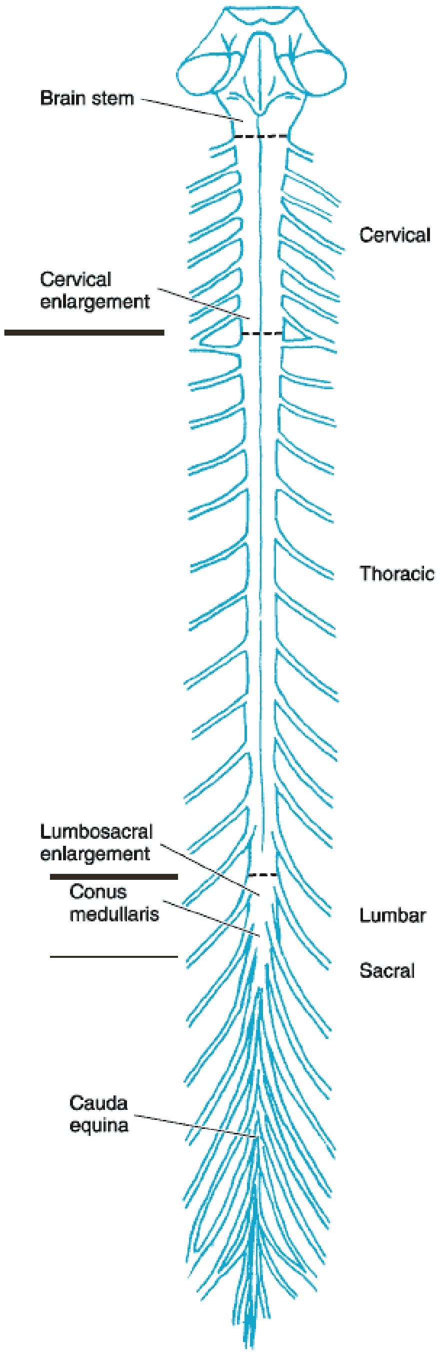
Spinal cord




medulla
Spinal cord

Cervical enlargement:
C4 toT 1
Source of brachial plexus

Lumbar enlargement :
L1 to S4
Source of nerves to lumbar &
Sacral plexus

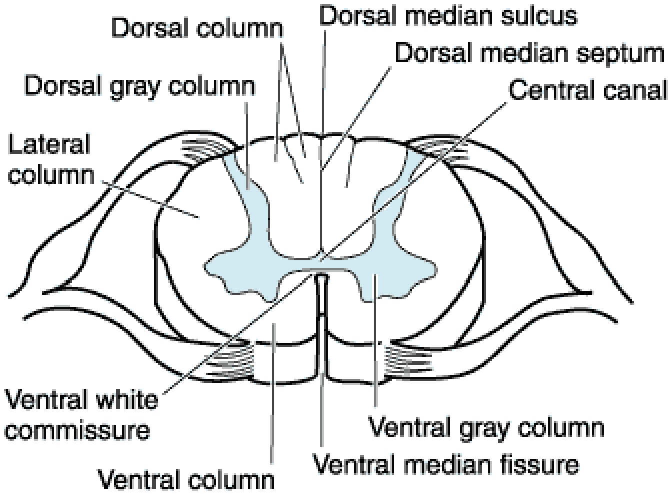


Grooves and Segments

- 31 segments
- 8 cervical, 12 thoracic, 5 lumbar, 5 sacral& 1 coccygeal
- each segment gives origin to a pair of spinal nerve

Grooves:

- Anterior median fissure
- Posterior median fissure
- 2 Posterolateral & 2 anterolateral sulcus

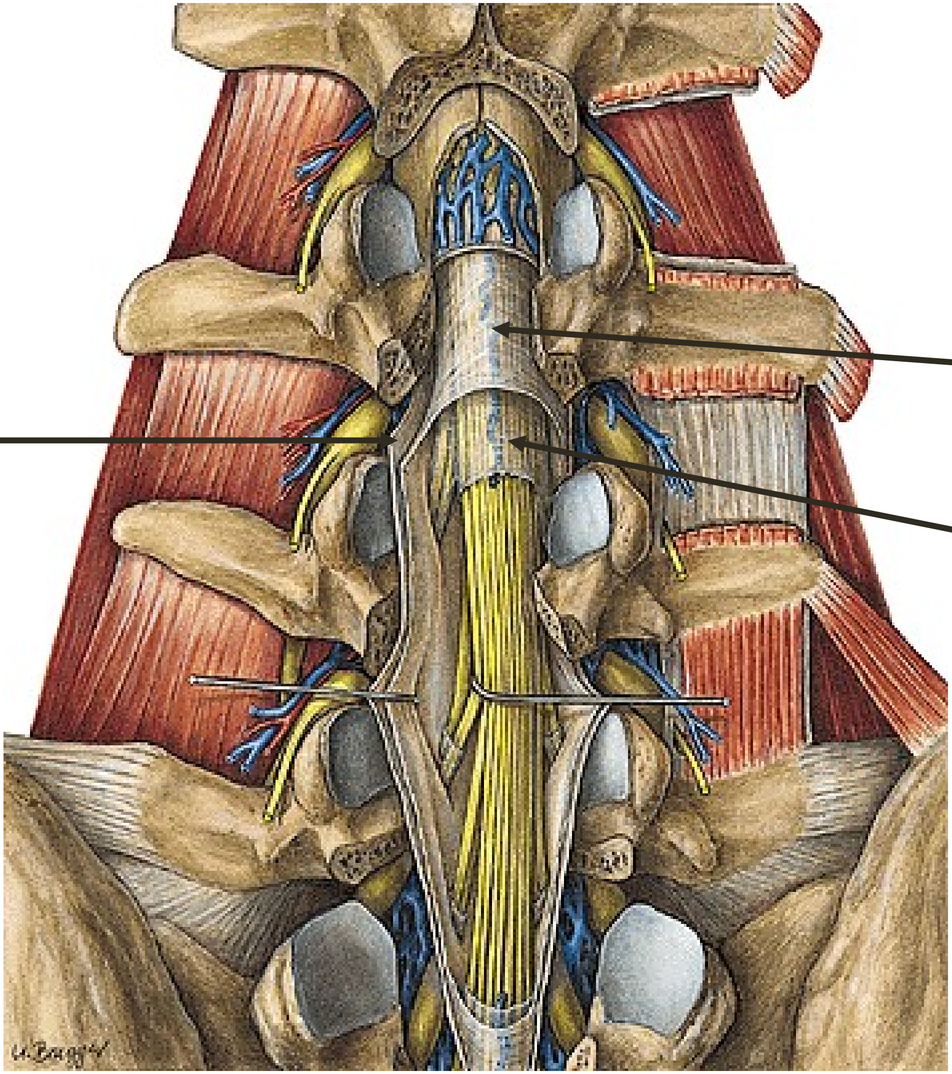


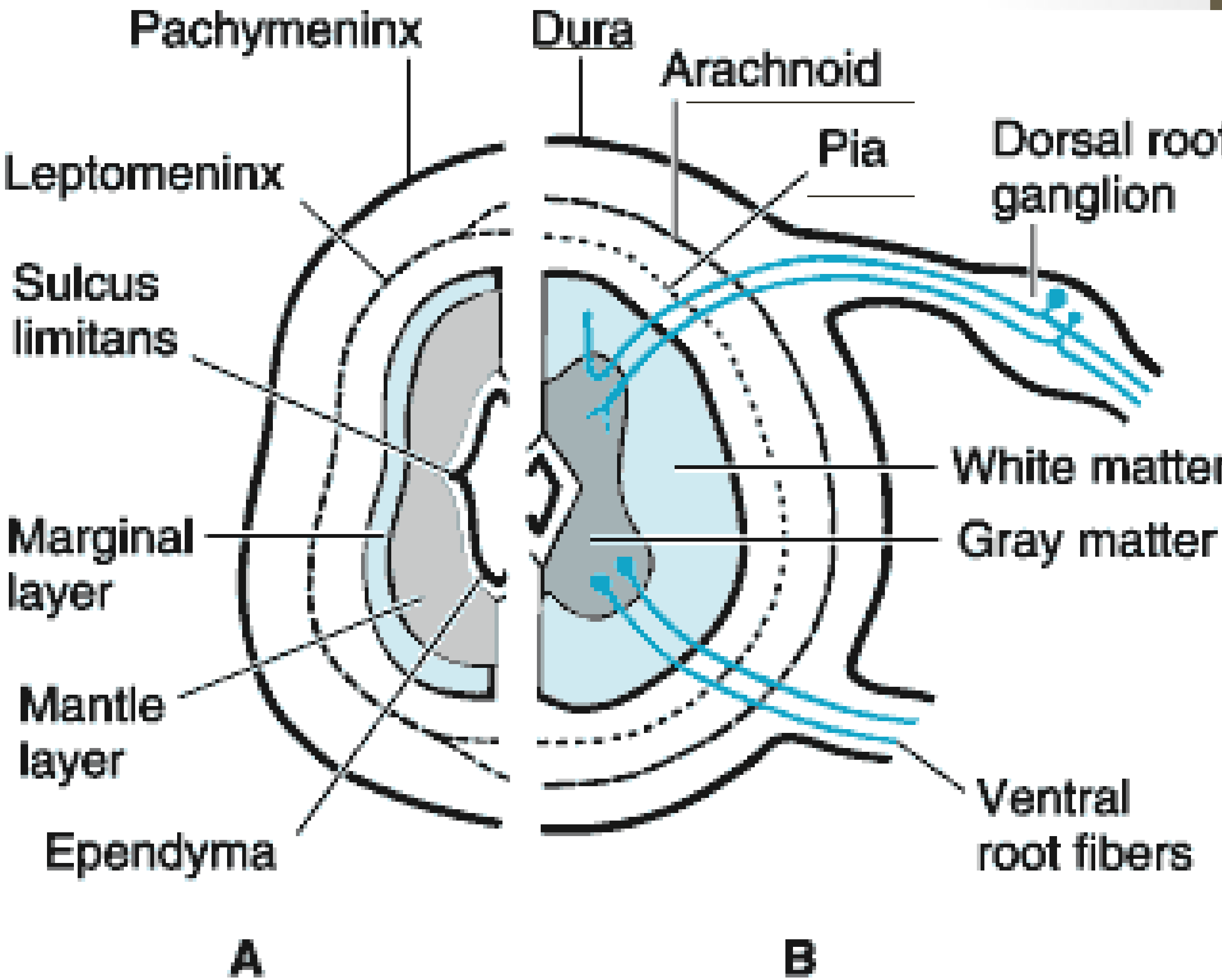
Coverings.

- Dura (outer layer) ,arachnoid (middle layer) and pia(inner layer)
- *Pia* forms a prolongation called filum terminale, attach to back of coccyx
- *Dura and arachnoid* ends at sacral 2

Spaces

- **Subarachnoid space: between arachnoid and pia** contains CSF& 3 ligaments: ligamentum denticulatum, subarachnoid septum
- **Subdural space** ; between dura and arachnoid contains fluid
- **Extra dural space**: between dura and walls of vertebrae it contains fat, small arteries ,venous plexus and lymphatics


Dura
Arachnoid
Pia


Pachymeninx
Dura
Arachnoid
Pia
Dorsal root ganglion
Leptomeninx
Sulcus limitans
White matter
Gray matter
Marginal layer
Mantle layer
Ependyma
Ventral root fibers
A
B

Internal Structure

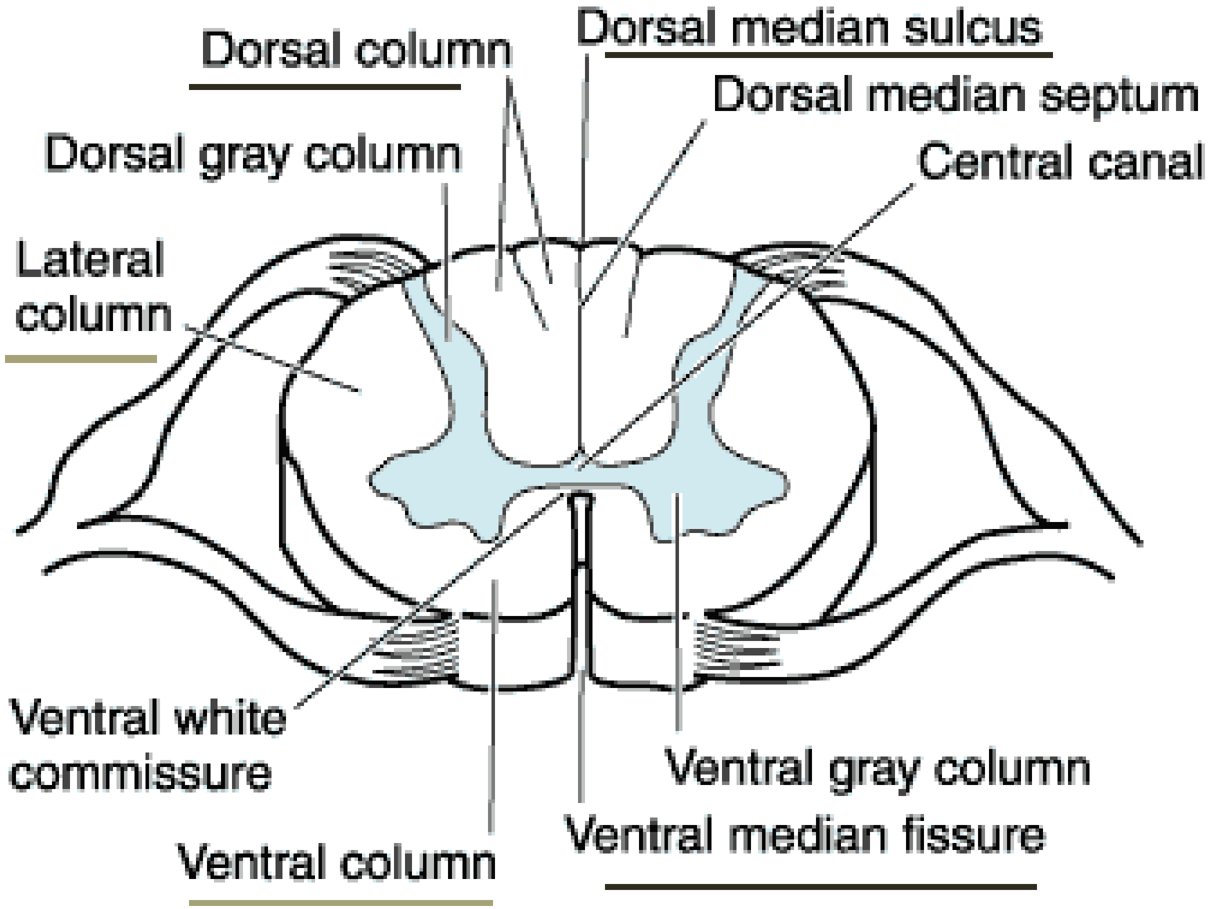
Grey matter : central H shaped with(nerve cells)

- dorsal horn: sensory
- ventral horn: motor
- Lateral horn: autonomic

White matter; 3 columns (myelinated nerve fibers)

- Anterior
- Lateral
- posterior

Central canal: narrow canal throughout the length


Dorsal column
Dorsal median sulcus
Dorsal median septum
Dorsal gray column
Central canal
Lateral
column
Ventral white
commissure
Ventral gray column
Ventral median fissure
Ventral column

Spinal Nerves

- 31 pairs
- Each is attached by 2 roots

Ventral root: motor from anterior horn& sympathetic from lateral horn

Dorsal root : purely sensory, carries dorsal root ganglion with pseudounipolar neurons

A- peripheral processes pass peripheral

B- central processes enters cord

- both roots unite to form **spinal nerve :** mixed
- Each nerve divides into **dorsal rami and ventral rami**

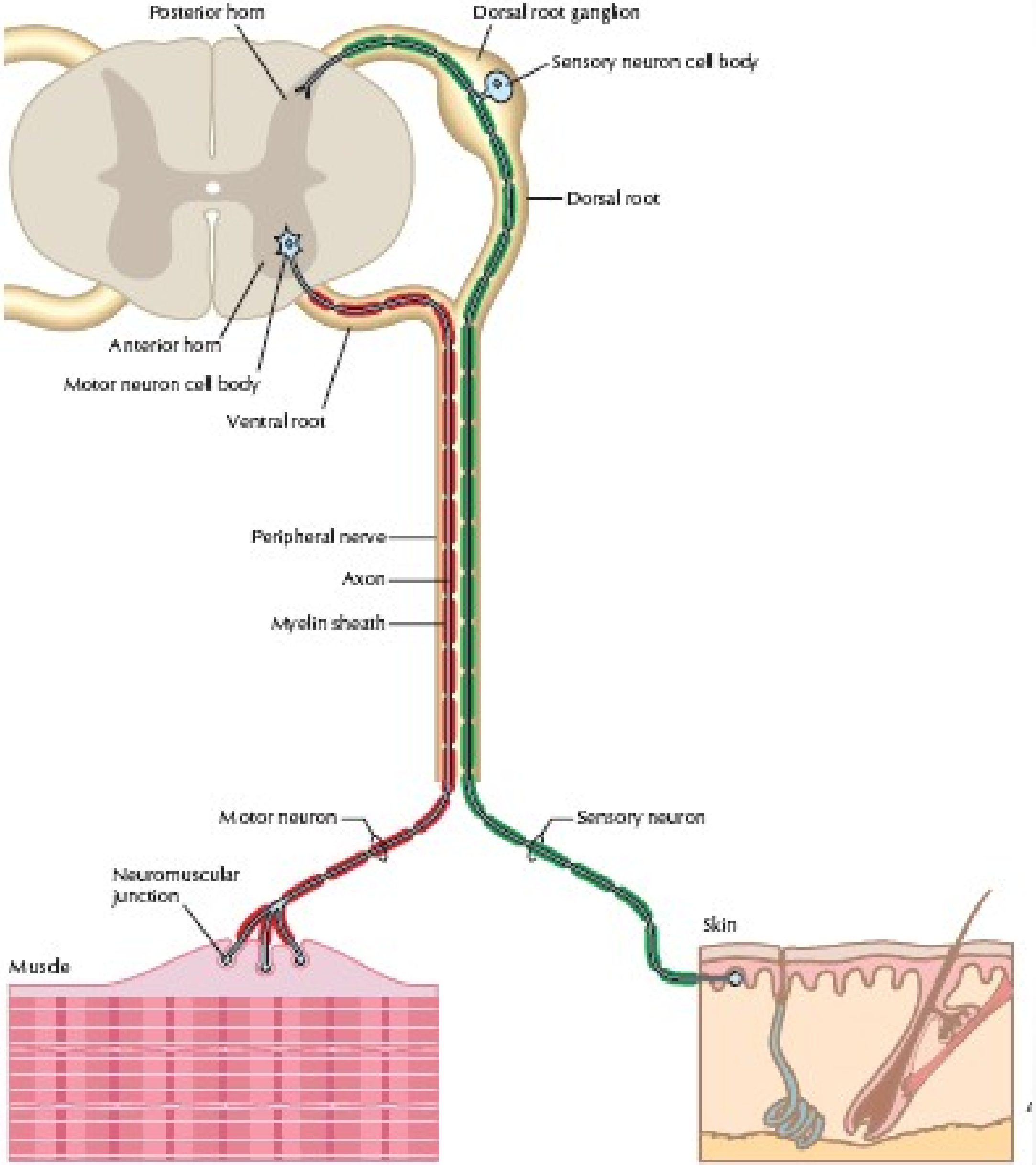
Spinal nerves

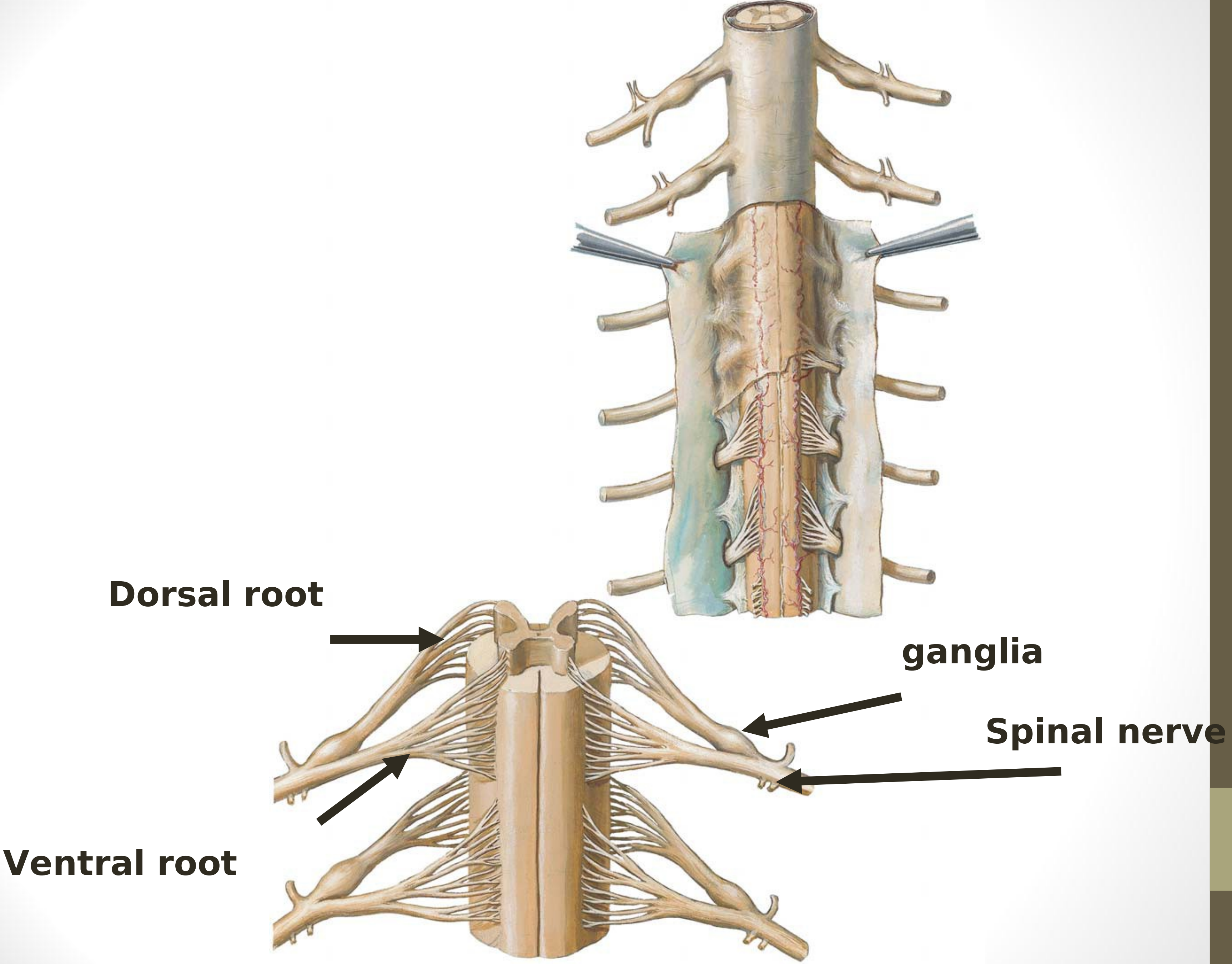
Anterior rami :

- form plexus except 12 thoracic
- Only 14 anterior rami from thoracic and upper 2 lumbar send preganglionic sympathetic fibers to sympathetic ganglia

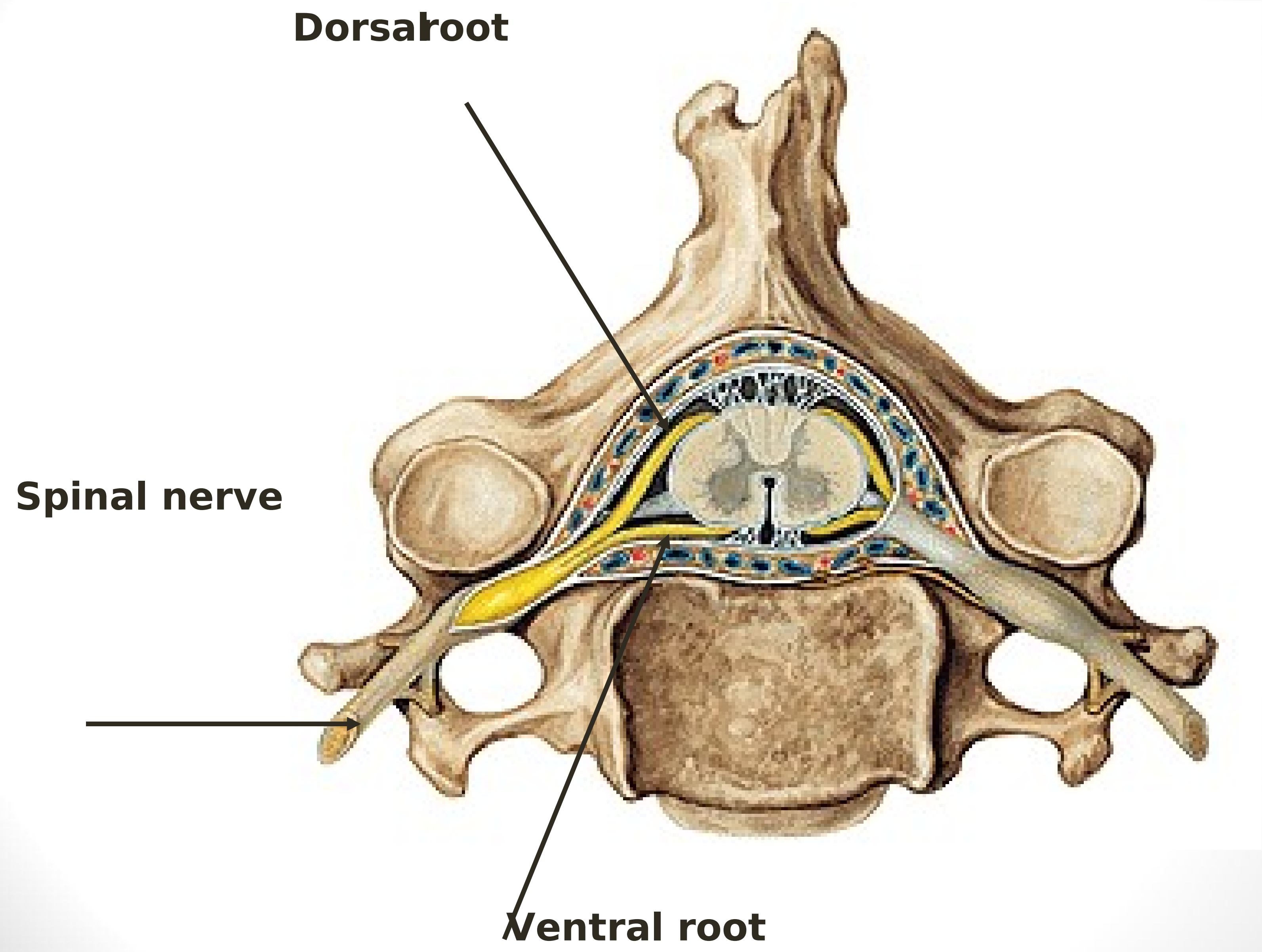
Posterior rami:

- small
- supply skin and muscles of back

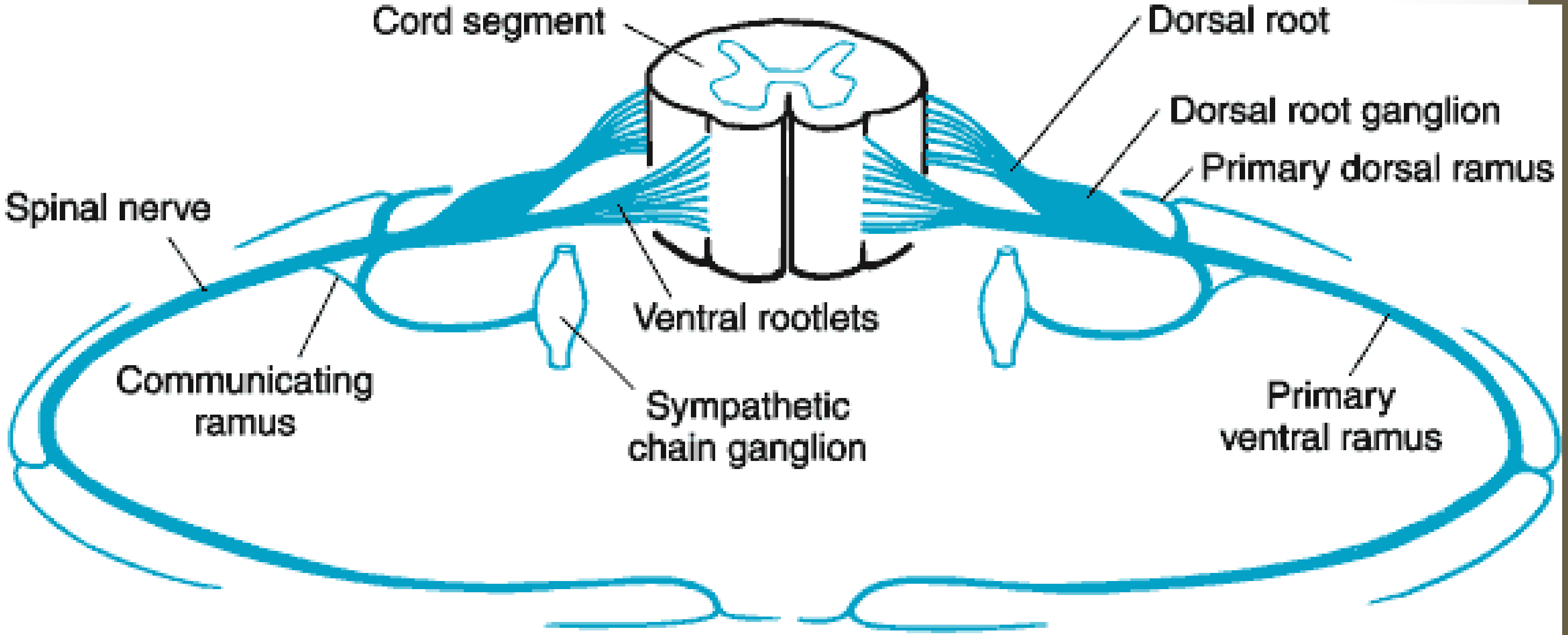

Posterior horn
Dorsal root ganglion
Sensory neuron cell body
Dorsal root
Anterior horn
Motor neuron cell body
Ventral root
Peripheral nerve
Axon
Myelin sheath
Motor neuron
Sensory neuron
Neuromuscular junction
Skin
Muscle

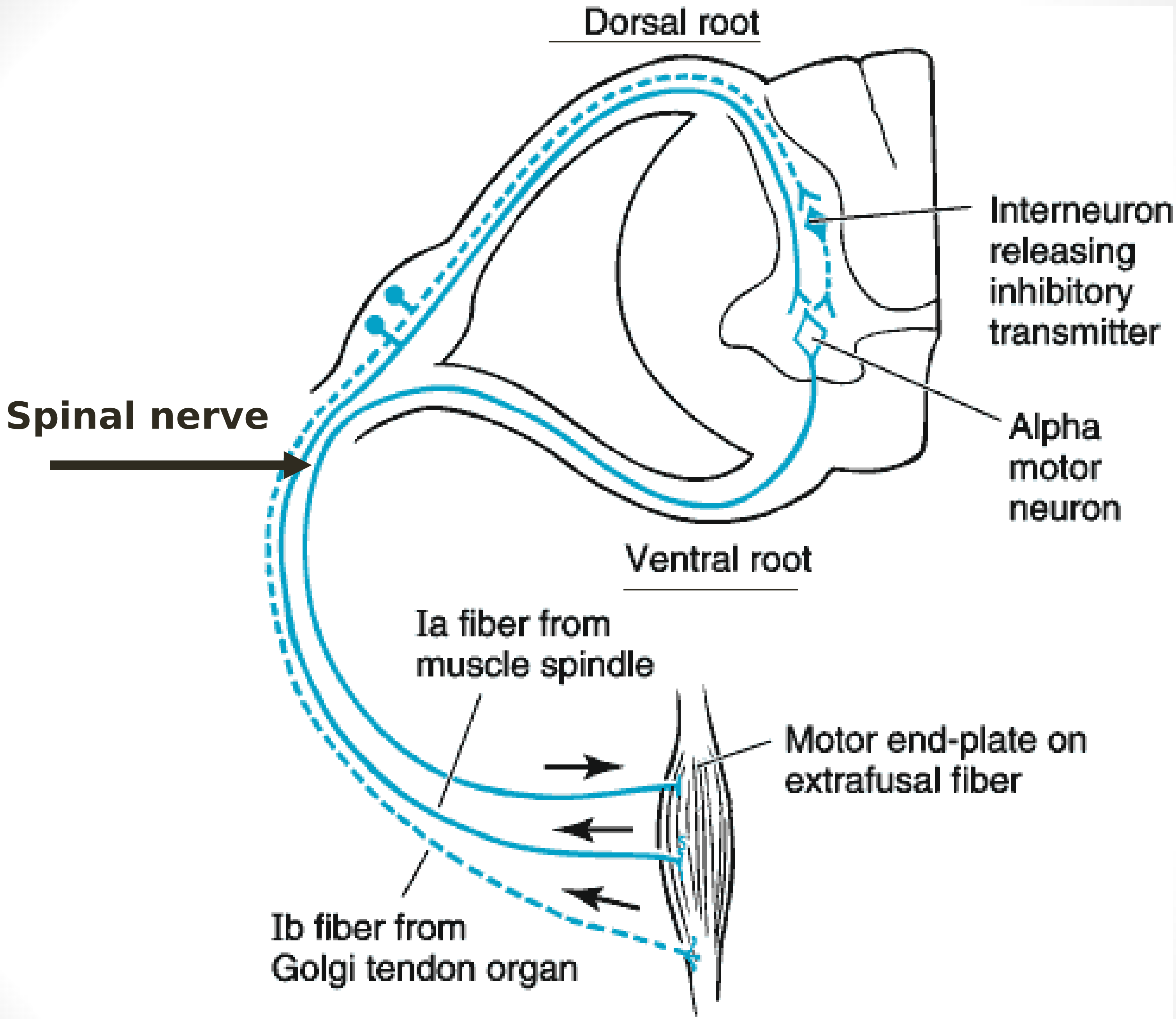


Dorsal root
ganglia
Spinal nerve
Ventral root


Dorsal root
Spinal nerve
Ventral root

Only 14 anterior rami 12 thoracic
And upper 2 lumbar send white ramus
Communicans to sympathetic chain

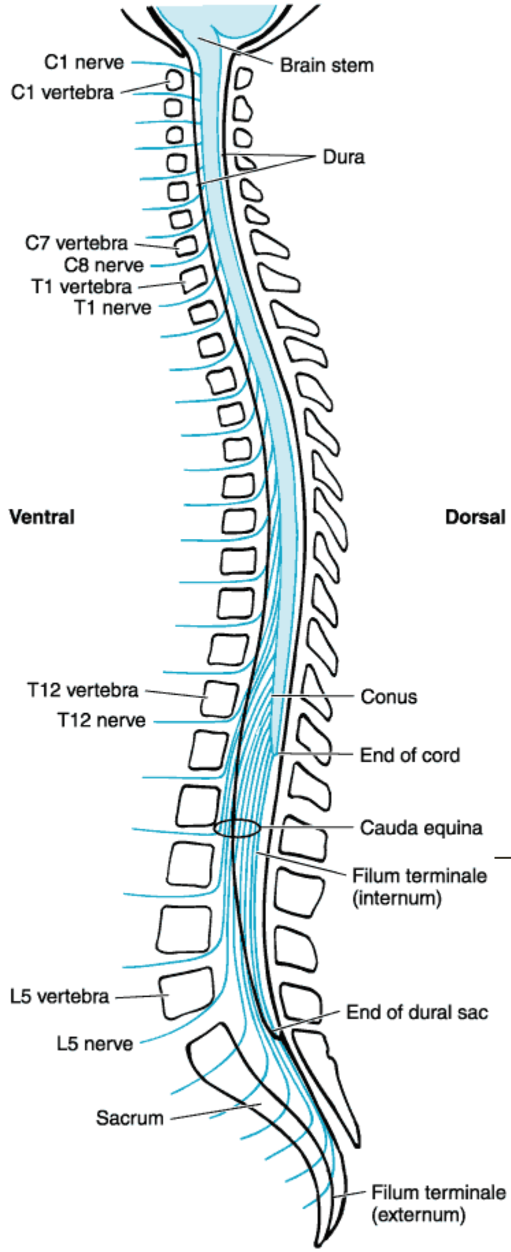



Dorsal root
Interneuron releasing inhibitory transmitter
Alpha motor neuron
Spinal nerve
Ventral root
Ia fiber from muscle spindle
Motor end-plate on extrafusal fiber
Ib fiber from Golgi tendon organ

Direction of Roots

- **C1 and C2** :   pass horizontal
- **C3 to T12**:   pass oblique
- **Lumber, sacral, coccygeal**

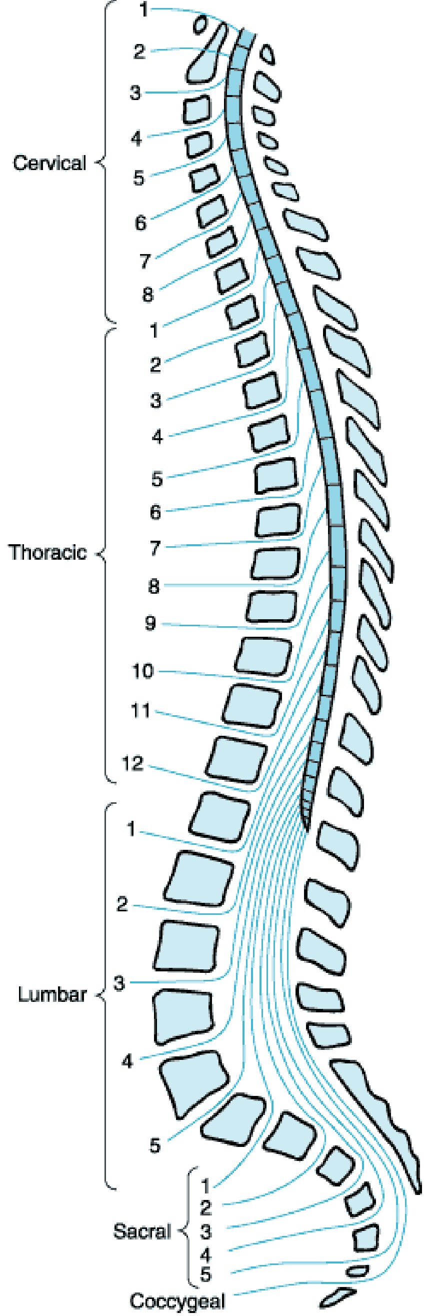
pass vertical in subarachnoid space to form **cauda equina**


C1 nerve
C1 vertebra
Brain stem
Dura
C7 vertebra
C8 nerve
T1 vertebra
T1 nerve
Ventral
Dorsal
T12 vertebra
T12 nerve
Conus
End of cord
Cauda equina
Filum terminale
(internum)
L5 vertebra
L5 nerve
End of dural sac
Sacrum
Filum terminale
(externum)

Spinal cord segments& levels

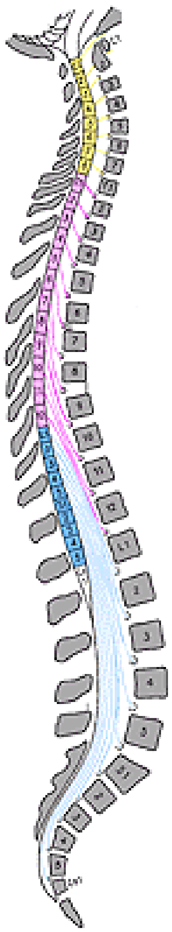
Spinal cord segments don't lie opposite the corresponding vertebra

- **Cervical region**: subtract one from **spinal cord** segment to get **number of vertebra**
- **In upper 6 thoracic**: subtract 2
- **In lower 6 thoracic**:   subtract 3
- **In lumber** : subtract 4
- **All sacral& coccygeal:** lie opposite L1 &L2


Cervical
1
2
3
4
5
6
7
8
Thoracic
1
2
3
4
5
6
7
8
9
10
11
12
Lumbar
1
2
3
4
5
Sacral
1
2
3
4
5
Coccygeal

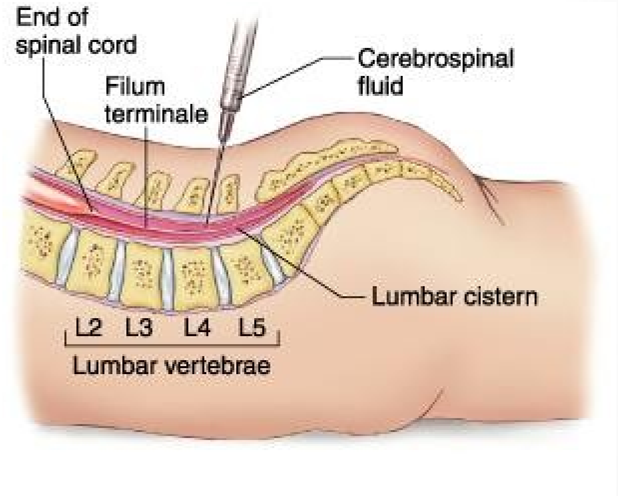
Exit of Spinal nerve

- C1 to C7 exit above the corresponding vert.
- C8 Passes below C 7 vertebra
- T1 –L5 passes below corresponding vertebra
- S1- S4 passes in sacral canal
- S5 passes in sacral hiatus



Lumbar Puncture

- In subarachnoid space
- Just above or below tip of **4 lumber spine**
- Opposite an imaginary line connecting the highest points of iliac crest
- Either diagnostic or therapeutic



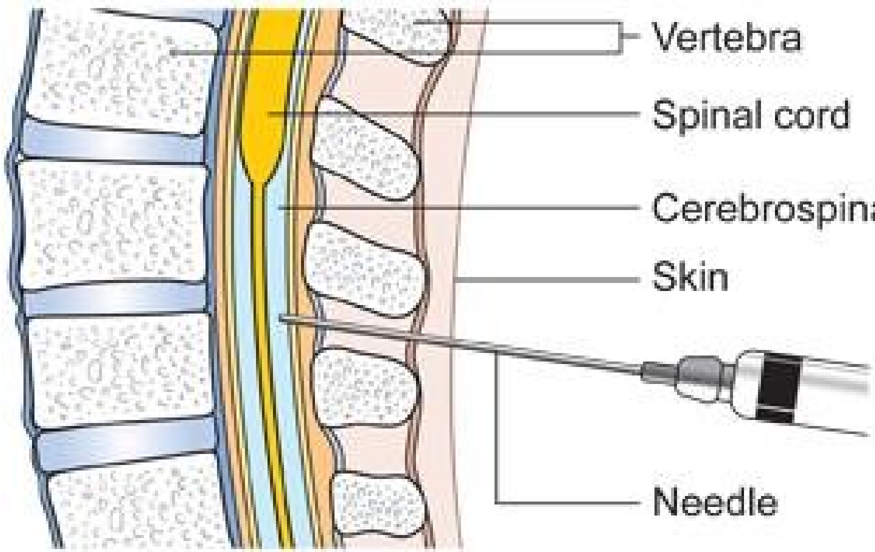


Diagram showing how you have a lumbar puncture


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